

Report for 2004SD18B: Hydraulic Calibration of the Upper Soil Layers in a Glacial Till System

There are no reported publications resulting from this project.

Report Follows

Annual Progress Report

State Water Resources Institute Program (SWRIP) March 2004 to February 2005

Title: *Hydrology model calibration in a glacial till system*

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Introduction

Runoff models could be used for estimating impacts in eastern South Dakota but they require validation with measured field data to be credible. This project will measure runoff rate and volume and be used to calibrate a runoff model such as HEC. Two sites have been established in small agricultural watersheds and will be used for this study. Additional data to be collected include precipitation at the sites, drain line flow rate, and water table elevations. Evapotranspiration will be estimated with measured weather data. One MS-level graduate student is funded with this project.

Current project

Previous research at these two sites and simulation of the hydrology of the sites have shown that adding subsurface drainage to a cropped waterway can increase the long-term average crop yield by eliminating catastrophic wet events in years of high rainfall (Kathol, 2003). The current project was established to validate the water balance model and to calibrate standard models such as DRINAMOD and HEC for these two sites.

Progress in 2003-4

Piezometers and monitoring wells were installed at both research sites in the fall of 2003. Two monitoring wells were installed at both sites. Fourteen piezometers were installed at each site.

Instrumentation was installed to continuously measure depth to water in monitoring wells and piezometers at both research sites. The ultrasonic sensors and associated data collection and transmission equipment were purchased from AgSense LLC, Huron, SD. The systems (Fig. 1) consist of ultrasonic signal generator/sensor units that mount in the PVC cap at the top of the well, wire to a control module, short-range telemetry to a short-term data storage module, then long-range telemetry to an internet access point. Power is provided by a small battery at each control module; a solar panel keeps the small battery charged. The data are retrieved remotely via WWW. The tipping bucket rain gauge is connected to the long-range telemetry so rainfall data are also retrieved via the WWW. Checking the rainfall data remotely can alert people on campus to rainfall amounts and

intensity and provide an indication of whether or not runoff was generated. If runoff was generated, the runoff sampler will be visited and the samples collected and returned to the analytical lab on campus.

The final data collection procedure is currently being refined. Occasional manual readings of water levels have been collected.

The early spring of 2005 was dry and resulted in no sampled runoff events. Early summer has brought more rainfall and the artificial drains are now flowing. Samples have been collected and laboratory chemical analyses are pending. A dry 2004 resulted in few runoff and drain flow samples.



Figure 1. Ultrasonic sensors atop two piezometer tubes, wire to the control module, and solar panel. The additional wire leads to other sensors (not shown).

The piezometric surfaces and hydraulic gradients to the artificial drain, water table elevations, weather data, runoff rates and volumes, and drain flow rates and volumes will be used to refine simulation models of the system. The models will include the spreadsheet water balance model generated in a previous project (Kathol, 2003), DRAINMOD, and HEC.

The remainder of CY2005 and early 2006 will be used to integrate the field data into the simulation models. Field data collection will continue through 2005 and into 2006. We expect that two MS theses will be generated in 2006. One thesis will be supported by funds from this project. The other will be supported by assistantship funds from the Agricultural Experiment Station and using the data generated in this project.

References

Kathol, J. P. 2003. Simulated corn yield responses in drained and undrained waterways. MS Thesis, South Dakota State University.